BANGALORE ELECTRICITY SUPPLY COMPANY LIMITED

(Wholly owned by Government of Karnataka Undertaking)

Technical Specification of Cable Jointing & Termination kits

1. SCOPE

The specification provides for supply, design, manufacture, test at manufacturer's works in presence of BESCOM representatives, suitable packing, transportation and off loading at BESCOM stores in satisfactory condition and proper stacking as directed by BESCOM or otherwise specified else -where. The straight through and end termination joints shall be used for XLPE, indoor or outdoor.

2. STANDARDS

All materials used and products provided under this specification must be in accordance with the standards listed below of this specification

REFERENCES:

1. IS 13573 (Part-2) : 2011 Type Test and Performance Requirements for cable Terminations and Joints on XLPE Cables from 6.6 KV to 33 KV ratings.
2. IEC 61238-1: Mechanical Connectors for Power Cables with copper or aluminum conductors - Tests Materials and Requirements.
3. EATS-09-13- Performance Specification for high voltage, heat shrinkable components for use with high voltage solid cables up to an including 11,000 volts.

All materials components and products offered shall be of the latest designs, incorporating any improvements in materials and installation procedures knowledge of which has been gained through the manufacturers' research or experience.

The jointing materials and components shall be offered in the form of kits. The kits shall be supplied complete with all necessary tubing's components (mechanical connectors/ earthing/ cable preparation etc) to form a ready to energize joint / termination.

3. SITE CONDITIONS

The joints shall be installed indoors and outdoors in any of the Utility in dusty atmosphere where the maximum humidity of 100% and maximum ambient temperature of 50 Deg.C. can be experienced. The straight through joints shall be suitable for continuous operation at the above site conditions.

4. SYSTEM VOLTAGE AND SERVICE CONDITIONS

4.1 Heat shrinkable kits are required for XLPE insulated cables in 11KV nominal voltage, 50Hz, 3 phase system with system highest voltages of 12kV.

4.2 Components shall not be adversely affected in any manner by contact with other material normally used in the construction of cable joints and terminations, and shall not increase the rate of corrosion of any metal with which they may come into contact. Assembled components forming part of a supply system shall perform without distress under the following conditions.

i) Normal conditions: Continuous operation at a conductor temperature of 90 Deg. C. for XLPE insulated cables.

ii) Fault conditions: Operation at a conductor and screen temp. Of 250 Deg.C. for XLPE.

5.0 TYPE OF CABLES FOR WHICH STRAIGHT THROUGH & END TERMINATION JOINTS ARE REQUIRED

5.1 For 11 KV XLPE Cables stranded, compact circular aluminum conductor, conductor screened with extruded semi conducting compound water tree retardant (TR), XLPE insulated, insulation screened with extruded semi conducting compound dry cured(Nitrogen gas cooled) from triple extrusion through common triple cross head (single point triple extrusion) in combination with copper tape cores laid up, Filler inner sheathed, galvanized round/strip steel wire armored and overall PVC sheathed Black colour cable conforming to IS:7098 /II/85 with latest amendments and as per specification detailed.

6,0 QUALITY, ENVIRONMENTAL MANAGEMENT SYSTEM AND LABORATORY ACCREDITATION

The kits offered from the factory having a valid IS0 9001:2000 Quality Management System(QMS) certificate for the goods offered. The goods include the shrinkable and moulded components, as well as connectors.

7.0 UNITS OF MEASUREMENT

In all correspondence, in all technical schedules and drawings metric units of measurement shall be used.

Heat shrinkable components

8.1.1.1 The term "heat shrinkable" is applied to extruded or moulded polymeric materials, which are cross-linked either by irradiation or chemical means, such that when their temperature is raised beyond the normal base polymer crystalline melting point, they do not melt but merely become rubbery. In this state if the material is then mechanically expanded and held in this position until the temperature falls below the

crystalline melting point, it remains in the expanded state. Sub-sequent heating in an unconstrained state will then result in the material recovering or shrinking" to its original extruded or moulded size and shape.

Product design shall be based on the use of heat-shrinkable or elastic tubings and moulded parts to provide for the functions of high voltage insulation, electrical stress control, electrical screening, sealing and environmental protection as necessary. The use of tapes to provide primary insulation, screening or primary stress control is not acceptable.

8.1.1.3 Bidders shall submit evidence with their BIDs that designs are based on sound engineering principles, accumulated know-how and satisfactory service experience.

8.1.1.4 Design shall aim at minimizing the number of component parts and the time and skill required for satisfactory installation. Complete external leakage insulation between the high voltage conductor and ground shall be achieved by utilizing heat shrinkable tubing and moulded parts. No filling medium shall be required.

8.1.1.5 These components shall be weather, ultra violet light and salt pollution resistant.

8.1.1.6 Full drawing of a joint and termination including all parts must be forwarded with the tender documents.

8.1.1.7 Technical characteristics already established for termination and joints must meet the minimum requirements as specified in standard EATS 09 -13-17.

8.1.1.8 Bidders must provide proof of weather and track resistance of the polymeric material offered, through actual field studies or through accelerated laboratory studies, to confirm a minimum of 30 years expectancy.

This should include:

(i) Thermal Endurance - An Arrhenius plot to confirm the life expectancy on continuous exposure at 90° C.

(ii) Tracking and Erosion Resistance Test to prove the withstand ability against effects of surface electrical leakage currents.

(iii) Weathering Data properties.

8.1.1.9 Type test Reports - Supplier should produce relevant type

test reports as per applicable IS or IEC or any other international standard for Joint, termination and Mechanical connector.

9. Documentary proof for

The heat shrinkable cable terminations (Indoor and Outdoor type) offered shall be Class-I terminations as defined in IEEE 48, and Suitable for very high pollution zone outdoor application as per IEC-60815 and also can be used in extreme pollution environment of specific creep age of 31 mm/kV. Type testing of heat shrink components as EATS-09-13 and Range taking type.

10. Stress Control Tube

- The stress control tube should be of heat shrinkable type
- The tube must have volume resistivity of minimum 10 raise to the power 10 ohms-cm
- Relative permittivity shall be minimum 15.
- Stress control impedance not to change over range of temp 0 to 125 deg C thermal endurance - confirmed through graphical depiction of variation in impedance with accelerated thermal ageing of 10,000 hours.
- High permittivity hot melt mastic is to be provided to prevent discharge activity at the steps. The minimum permittivity of the mastic shall be minimum of 5 and maximum up to 20. Semi conducting paints are not acceptable.
- Fluorinated silicone grease shall be provided for filling up the nicks and scratches on the surface of XLPE insulation.

11. Non-tracking erosion and weather resistant protection.

The entire surface, from the high voltage point (lug) to the earthling point of the XLPE core/ cable shall be insulating having non-tracking properties, tracking and erosion resistant, and hydrophobic in nature.

The material used for manufacturing the non-tracking tubing's and rain sheds (skirts) material shall have an assessed life exceeding 40 years.

Test reports pertaining to accelerate weathering tests of at least 5,000 hours (minimum) shall be submitted in support of this assessment as per ASTM G53-

90 Method A & ASTM D 4329. Longer duration accelerated testing wherever conducted shall be given preference.

Load cycling tests alone, shall not be considered sufficient basis for such life assessment.

Test report as per ASTM D2303 to be submitted.

Environmental Sealing:

- **Adhesives and sealants** shall be provided in the termination kits for environmental sealing against ingress of moisture and aggressive gases.

- The adhesives and sealants will flow due to heating of heat shrinkable components or otherwise during installation and will fill all voids and adhere to metal components and cable sheaths.

For terminations:

The sealing of the strands between the mechanical connectors and cable termination shall be provided by:

a) Non-tracking, erosion and weather resistant non-tracking sealant coated over the inner side of heat shrinkable outer tubing.

b) Non-tracking sealant strips.

c) The sealants must have unlimited shelf life.

i) Mechanical connector

Pre-engineered Mechanical connectors with torque controlled shear head bolts. The offered connector should be tested as per IEC 61238-1 including 1000 heat load cycles & short circuit test.

Connector should be range taking with 3~4 sizes covering 25 sq.mm to 400 sq.mm & made of a high-tensile, tin-plated aluminium alloy suitable for both aluminium & copper conductor. The internal surfaces of the conductor holes are grooved. Connectors are to be chamfered at the edges and available with or without oil barrier (as blocked and unblocked types) depending on the application requirements. The shear head bolts to be made of a special aluminium alloy, these

contact bolts should be shear-head bolts with hexagon heads. The bolts are to be treated with a highly lubricating agent. Contact bolts are irremovable once their heads have been sheared off. Connectors should be designed with removable inserts so as to accommodate lower cross section cable conductors & centre it.

12. GUARANTEED TECHNICAL PARTICULARS

Sr. No.	Particulars	11 KV
1.	Name of Manufacturer	
2.	Applicable Standards	IS: 13573- Part 2, 2011, IEC 61238-1 EATS-09-13
3.	Rated Voltage of Cable accessories	6.35/11 kV
4.	AC / DC Voltage Withstand (Dry)	28.5 kV AC for 5 minute / 25.4 kV for 15 min
5.	AC Voltage Withstand (Wet) (for Outdoor termination)	25.4 kV AC for 1 minute
6.	Partial Discharge (Temp of conductor at Ambient and elevated temp) @ 1.73 U_0	Less than 10 pC at 11 kV @ ambient and at elevated temp
7.	Impulse Voltage (Temp of conductor at Ambient and elevated temp)	10 impulses of each polarity @75 kVp at Ambient and elevated temp
8.	Load Cycle test	Total cycle = 60 nos.
	a. Each cycle heating duration	5 hours (maintain 2 hrs min as steady state)
	b. Temperature	100° C
	c. Cooling Duration	3 hours
	d. Continuous Phase to earth Voltage withstand	15.8 kV
9.	Humidity Test	300 hours duration withstand at 8 kV AC
10.	Salt Fog Test	1000 hours duration withstand at 8 kV AC
11.	Thermal Short Circuit test	Two shots As per Cable cross section and material of conductor
12.	Dynamic Short circuit test	2.55 times the thermal short circuit current
13.	Method of Stress Control	Heat Shrinkable type
14.	Tubing's & Molded parts	Heat Shrinkable type
15.	Non Tracking material	Confirming as per ASTM D-2303
16.	Di-electric strength of insulating material	10 kV/mm min